GRADUATE STUDY AND RESEARCH

IN THE DEPARTMENT OF

Theoretical and Applied Mechanics

UNIVERSITY OF ILLINOIS BULLETIN

The information in this booklet is limited to matters of most general interest to prospective graduate students in order that they can get a clear, though brief, concept of the Department of Theoretical and Applied Mechanics, its course offerings, and its research opportunities.

For additional information, address

DEPARTMENT OF THEORETICAL AND APPLIED MECHANICS
214 Talbot Laboratory
University of Illinois
Urbana, Illinois

REGISTRATION for the first semester normally is held during the second week of September, for the second semester during the first week of February, and for the summer session during the second week of June. A graduate student may enter the University at any of these times.

APPLICATION forms for admission to the Graduate College may be obtained from the Dean of the Graduate College or Director of Admissions and Records, University of Illinois, Urbana, Illinois.

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THE DEPARTMENT OF

Theoretical and Applied Mechanics

CONTENTS

Graduate Faculty 5

The Department of Theoretical and Applied Mechanics 6

Importance of Graduate Study in Theoretical and Applied Mechanics 9

Admission to the Graduate College 10

Degree Requirements
- General 11
- Departmental 12

Requirements for the Degree of Master of Science in Theoretical and Applied Mechanics
- General 12
- Residence 12
- Work Done Elsewhere 12
- Majors and Minors 13
- Foreign Language 13
- Thesis 14

Requirements for the Second Master's Degree 14

Requirements for the Degree of Doctor of Philosophy in Engineering
- Residence 14
- Work Done Elsewhere 15
- Majors and Minors 15
- Language Examinations 16
- Preliminary Examinations 16
- Thesis 16
- Final Examination 17

Advisers 17

Grades 17

Part-time Work and Study 18

Facilities of the Department of Theoretical and Applied Mechanics 18
Large Crane Bay 19
Small Crane Bay 20
Concrete Research 20
Hydraulics and Fluid Mechanics 20
Properties of Materials 20
Fatigue 21
Plastics 21
Vibration 21
Photoelasticity 21
Creep 22
Railroad Rails 22
Railway Car Wheels 22
Machine Shop 23
Collection of Photographs 23
Mechanics Club 23
Miscellaneous 23

Engineering Library 23

Graduate Courses in the Department of Theoretical and Applied Mechanics 24

Suggested Courses in Other Departments 29

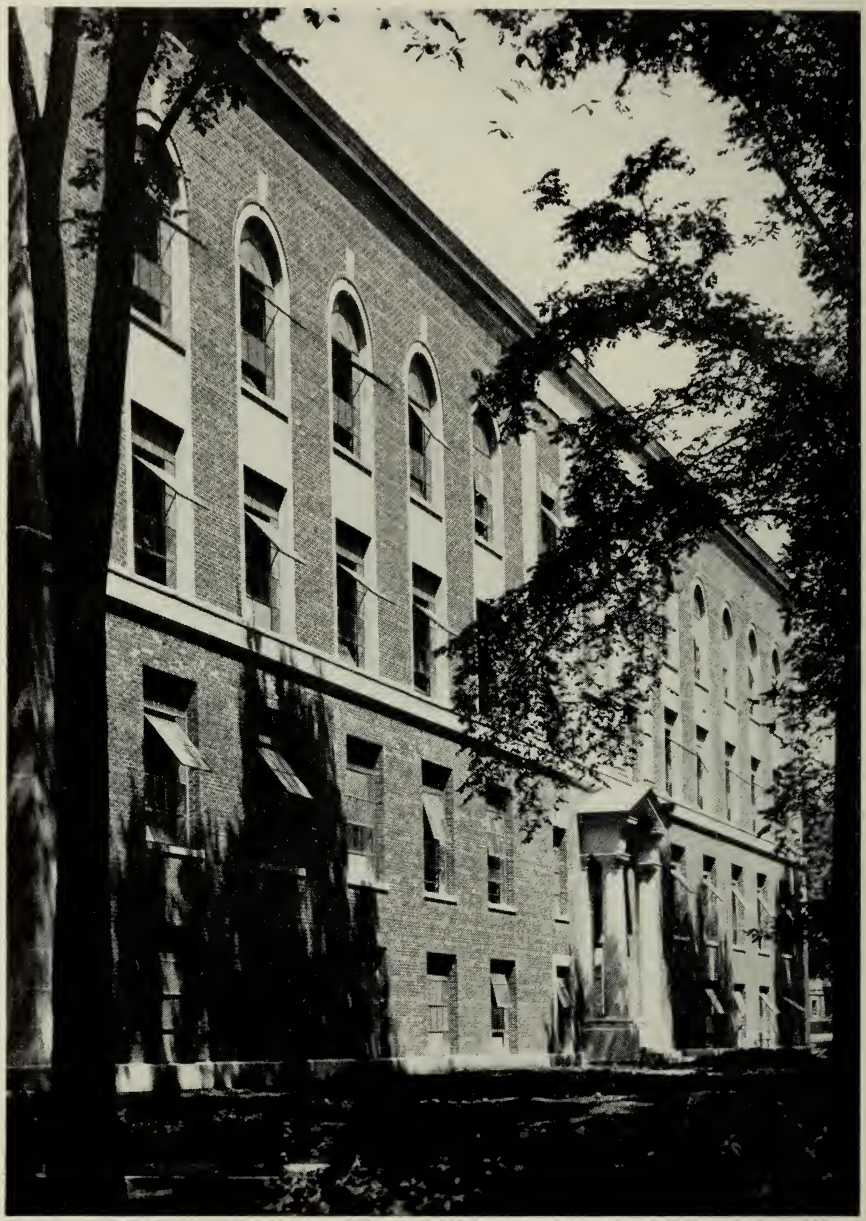
University Fellowships 30

Teaching Assistantships 32

Research Assistantships in the Engineering Experiment Station . . 32

Fees and Expenses 34

Housing 35



The Arthur Newell Talbot Laboratory houses most of the staff and equipment of the Department of Theoretical and Applied Mechanics.

GRADUATE FACULTY OF THE
DEPARTMENT OF THEORETICAL AND APPLIED MECHANICS

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THOMAS J. DOLAN, M.S., Professor and Head of the Department

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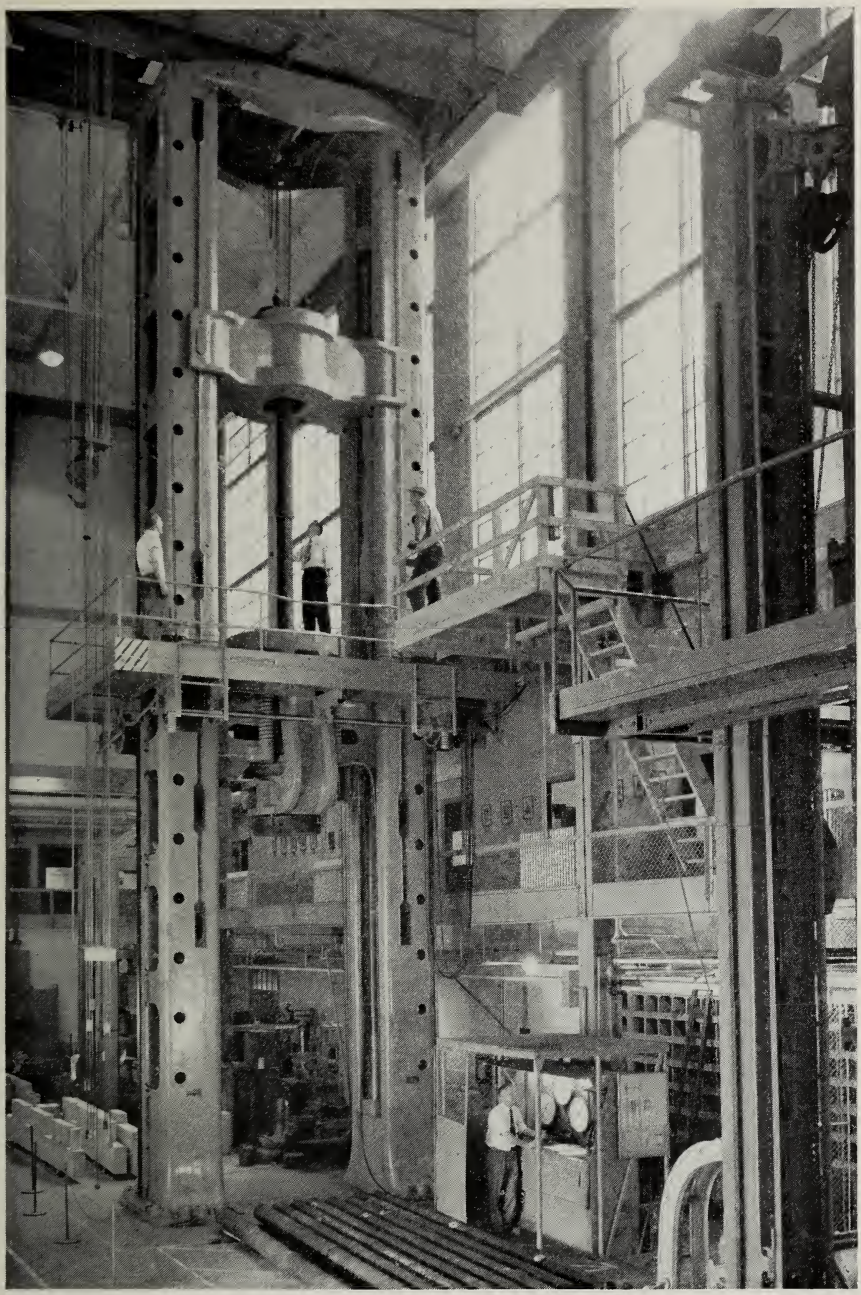
THE DEPARTMENT OF THEORETICAL AND APPLIED MECHANICS

The Department of Theoretical and Applied Mechanics, a separate department in the College of Engineering, offers a complete graduate program of courses and research leading to the degrees of Master of Science and Doctor of Philosophy in Theoretical and Applied Mechanics. Graduate students were first enrolled in the Department in 1908, and at the present time (1954) about twenty-five advanced students, equally divided between candidates for the doctor's and master's degree, are registered in the Department. In addition, about three times that number from other departments of the College, such as mechanical, civil, aeronautical, chemical, agricultural, etc., take courses in mechanics in partial fulfillment of the degree requirements.

On the undergraduate level, the Department of Theoretical and Applied Mechanics administers and teaches the required undergraduate courses in mechanics, but does not award an undergraduate degree. Consequently nearly all the undergraduate students in the College of Engineering take their work in statics, dynamics, strength of materials, hydraulics or fluid mechanics, and hydraulics and materials laboratory in the Department and, in general, have been doing so since its establishment in 1890 as a separate unit in the College of Engineering.

In the program for graduate study emphasis is placed on both course work and research, the latter being either analytical or experimental. As the name of the Department implies, the research is both "theoretical" and "applied" and may be divided into two general classifications, that financed by departmental funds and carried on primarily by the teaching staff (it has long been believed that teaching and research go hand-in-hand), and second, the cooperative investigations financed by industry, industrial organizations, or governmental agencies. The Department, as part of the Engineering Experiment Station, actively conducts many research investigations and makes studies of importance to the engineering, manufacturing, and other industrial interests as well as to various governmental agencies. Some of the fields of greatest research activity are properties of materials and the elastic and inelastic behavior of load-resisting members; fatigue of metals; reinforced concrete beams, columns, footings, slabs and frames; creep of lead and of plastics and other inelastic behavior of materials; hydraulics and fluid mechanics; stresses in railway car wheels, rails, and bolted and welded rail joints; mechanical vibrations of machines and structures and vibration damping; photoelastic, electric strain gage, and other methods of experimental stress analysis; constant humidity and temperature investigations of

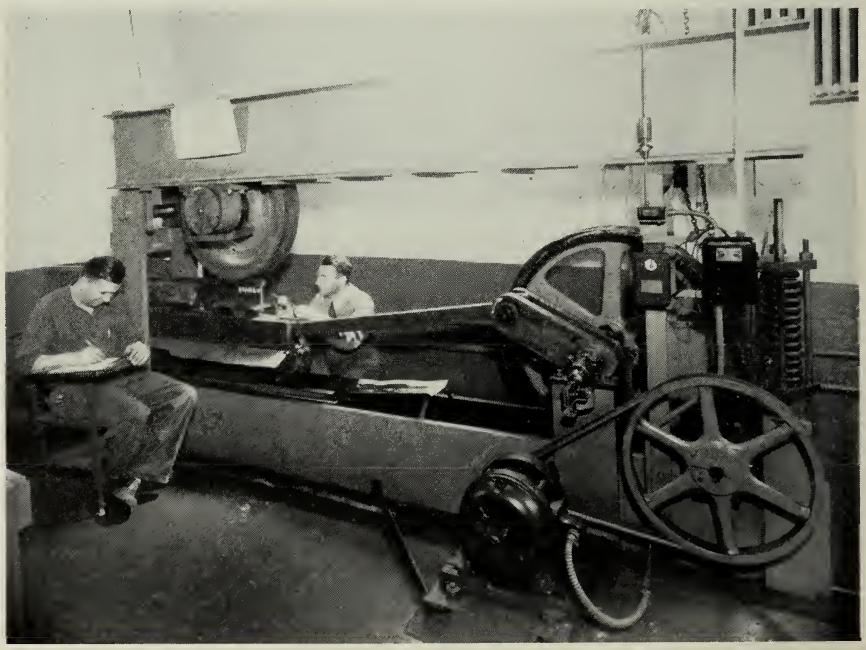


The 3,000,000-lb. Emery-Tatnall hydraulic machine capable of handling specimens 7.5 ft. wide and 38.5 ft. long in tension or compression is used to study the deformational behavior under load of large members. For use in bending, see page 19.

plastics; materials subjected to static and dynamic loads; theoretical analyses of problems in fluid flow, dynamics, theory of elasticity, and theory of plasticity.

The presence of the cooperative investigations makes available to the graduate student much equipment and many facilities for research that otherwise would be impossible to procure. In addition, a graduate student may actually participate in such research work as a part-time employee, research assistant, or by virtue of selecting as a thesis subject a problem pertinent to or actually an important part of a cooperative investigation. The results of much of the research, and at times the outgrowths of thesis work, are published as bulletins of the Engineering Experiment Station or in the technical publications of the various engineering societies. A complete list of the bulletins may be secured by writing to the Director of the Engineering Experiment Station, University of Illinois, Urbana, Illinois.

The research projects vary extensively in type. Some of them are definitely of a basic or fundamental scientific nature involving both analytical and experimental approaches; others are more nearly of the applied type; some are primarily theoretical. The specialized nature of



Service-type failures in railroad rails, joint bars, and welded rails are produced in specially designed machines simulating service loads.

much of the experimental work makes valuable the ability to develop new equipment, to obtain data, and to interpret and correlate experimental data with theory — all highly desirable experiences with which a graduate student should be associated. The illustrations in this booklet show some of the specialized equipment and machines used in investigations that involve analytical, mathematical, or theoretical aspects of problems.

IMPORTANCE OF GRADUATE STUDY IN THEORETICAL AND APPLIED MECHANICS

The recent and rapid industrial developments and their increased scientific nature in certain applications have created a growing demand for engineers who have studied advanced theory and who have had training in research. This is true for all branches of engineering — civil, mechanical, aeronautical, electrical, metallurgical, agricultural, etc. — and it is in all of these fields that engineers are needed who have a training that is basically scientific or fundamental in its approach. The graduate study of theoretical and applied mechanics is a training that integrates the fundamentals of physical science, mathematics, and engineering required for the understanding of the behavior of real engineering materials and their uses under a wide variety of conditions. Specifically, a few fields of work for which graduate study in mechanics is desirable and for which it prepares the engineer are as follows:

1. Fundamental scientific investigation and research and development in industrial, educational, or governmental organizations to extend the boundaries of present knowledge.

2. Teaching fundamental engineering concepts and ideas on the college level, combining the desire to do research with the teaching and incorporation of new material into existing courses.

3. Advanced analysis, design, or consulting work in specialized areas.

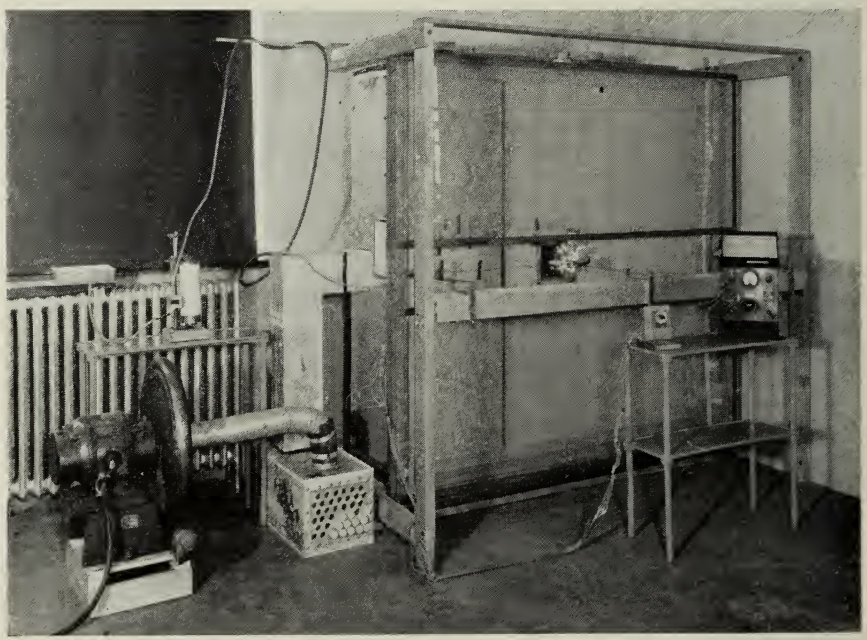
The exact fields of specialization in mechanics are many and varied, but they cut across or overlap most of the conventional branches of engineering. The fields of specialization may be theory of elasticity, theory of plasticity, fatigue, creep, dynamics, vibrations, fluid mechanics, plain or reinforced concrete, etc. From these examples it becomes apparent that men with bachelor's degrees in any engineering curricula, who have had the equivalent of the required undergraduate courses in mechanics, may pursue graduate work in mechanics; it matters not whether the undergraduate work was civil, mechanical, metallurgical,

etc. For example, if the subject of jet propulsion is considered, there are problems in dynamics, air and fluid flow, repeated loading, effects of temperature and time on materials, elasticity and plasticity, all of which are problems in mechanics that are closely related to many of the common branches of engineering.

ADMISSION TO THE GRADUATE COLLEGE

The general requirement governing admission to the Graduate College is graduation from an institution whose requirements for the degree of Bachelor of Science are substantially equivalent to those of the University of Illinois, provided the applicant's undergraduate grade-point average for that portion of work which represents the last fifty per cent of hours completed to obtain the bachelor's degree, exclusive of required physical education and military training, is at least 3.5,[1] and provided further that the undergraduate preparation is appropriate to advanced study in the chosen major field. If these requirements are met, the student is

[1] An average of 3.5 is a grade-point average half-way between C and B in the grading system where A corresponds to 5.0, B to 4.0, etc.



Theoretical deflections of large, thin, flat plates are compared with measurements of deflections produced by exhausting air from a box faced with a 6 ft. by 6 ft. glass plate.

admitted with *full status;* if the 3.5 grade-point average is not met the student may be admitted on *limited status.*

Those students who hold a bachelor's degree and have completed one or more years of graduate study at accredited institutions, and who desire to become candidates for the degree of Doctor of Philosophy at the University of Illinois, are admitted with *advanced standing* only upon the favorable recommendation of the head of the department of the major field of study and of the Dean of the Graduate College. If admission is granted, the amount of credit to be allowed will be determined by the Dean upon the recommendation of the head of the department. (Also see pages 12, 14, and 15.)

Prospective students are urged to submit their applications for admission, on forms obtained from the Director of Admissions and Records or from the Dean of the Graduate College, several weeks in advance of the opening of the session in which they plan to enroll. An official transcript from each college attended must accompany the application, which is to be sent to the Director of Admissions and Records, Room 100a, Administration Building. Graduate students may enter the University at any of the three registration periods, September, February, or June, but the number of courses offered during the eight-week Summer Session is usually limited and a prospective student should not anticipate a full summer program without making inquiry.

DEGREE REQUIREMENTS

General. The requirements of the Graduate College for the awarding of degrees are explained in detail in the University of Illinois bulletin for the Graduate College. The information presented on the next few pages consists of pertinent extracts from that bulletin as well as additional information in order that the prospective graduate student can get a clear, though brief, concept of the Department of Theoretical and Applied Mechanics, its course offerings, its research opportunities, and its general method of functioning. All of these items are important to the prospective graduate student because he is not expected to gain all the knowledge and training necessary to meet the degree requirements from formal classroom and laboratory courses. Progress toward an advanced degree is measured not only by an accumulation of units of credit but also by evidence of intellectual growth and achievement. Graduate study presupposes maturity of outlook.

Departmental. Graduate students electing Theoretical and Applied Mechanics as their major[1] must have had the equivalent of the undergraduate courses in mechanics required for a bachelor's degree in any of the curricula in the College of Engineering of the University of Illinois. For those electing a minor[1] in Theoretical and Applied Mechanics the undergraduate requirements are, in general, the same as for a major, except for modifications depending on the student's interests and objectives. Students on limited status (those admitted to the Graduate College but whose undergraduate work does not meet the requirements for admission to the Graduate College) may elect to take courses in Theoretical and Applied Mechanics as a minor only.

REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN THEORETICAL AND APPLIED MECHANICS

General. A candidate for the master's degree must satisfy residence requirements, must complete a minimum of eight units with satisfactory grades, and must submit a thesis unless an excuse is approved, as stated on page 14. Before the degree will be granted, departmental requirements must be satisfied in addition to those stipulated by the Graduate College.

Residence. A candidate for the master's degree is required to be in residence for the equivalent of at least two semesters during each of which he is registered for at least two units of work. Students in actual residence who are carrying lighter programs of study must spend a proportionately longer time in satisfying this residence requirement; thus, for example, a student employed as a full-time assistant but registered for one unit a semester would discharge the residence requirement in four semesters of work.

Attendance in residence during four summer sessions in each of which the student is registered for not less than one unit of work, or one semester with not less than two units and two summer sessions with not less than one unit each, is regarded as the equivalent of two semesters in residence. Registration for more than two units in a regular semester, or for more than one unit in a summer session, will not shorten the time which must be spent to discharge the residence requirement.

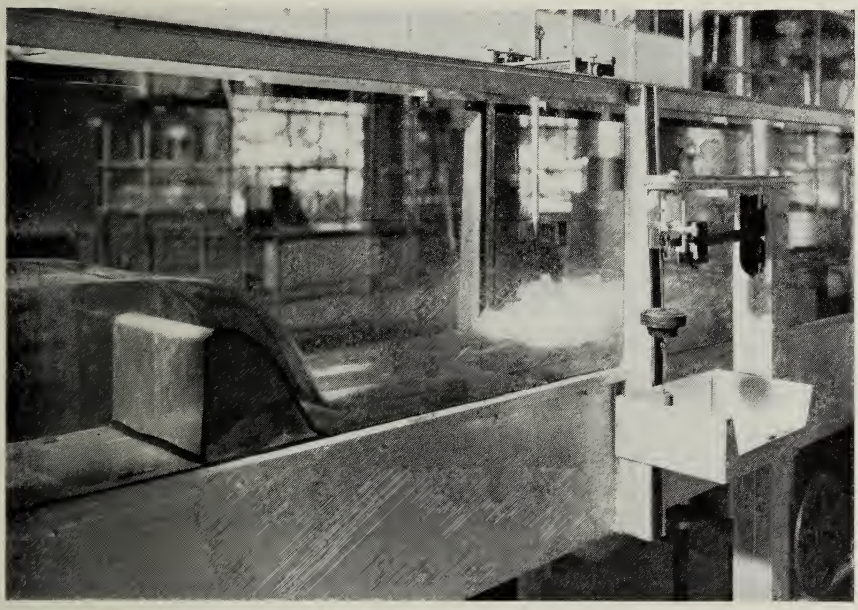
Work Done Elsewhere. A graduate student who has taken graduate work in other approved institutions may obtain not more than four units of credit for such work (provided it is similar to offerings at the University of Illinois in the chosen major or minor field) by passing departmental examinations in the work. Admission to such examinations

[1] See page 13 for the master's degree and page 15 for the doctor's degree.

requires the approval of the Dean of the Graduate College. Such a student may complete the work for the master's degree by completing additional units while registered in the Graduate College for at least two semesters.

Majors and Minors. A candidate for a master's degree may do all his work in one field, or he may select a major and one minor, or a major and two minors. A major or minor denotes the field of knowledge of a department, or such part thereof as constitutes a separate and independent division of that field. For a master's degree a major comprises work totaling a minimum of four units; the minimum course requirement for a minor is one unit.

Foreign Language. The ability to use one or more of the modern languages, usually German or French, ordinarily studied in the undergraduate curriculum is desired for all candidates for the master's degree, but is not required. A student who wishes to go beyond the master's degree to the doctorate should take at least one of the Graduate College language examinations during the first year of graduate study, for no residence may be counted for the second year of the student's work for the doctorate until he has passed at least one language examination.



Glass-walled tilting flume 18 in. wide, 26 in. deep and 30 ft. long is used to study hydraulic jump, velocity distribution, and hydraulic similitude.

Thesis. The subject of a thesis for the master's degree must be filed at the Graduate College office by the student during the registration period prior to his graduation. A student usually devotes two units of work to his master's thesis, and not more than three units of thesis credit may be earned for that degree except by special permission. For specific instructions with reference to the preparation and form of the thesis, the student can obtain at the Graduate College office a copy of the leaflet "Instructions for Preparation of Theses."

The requirement of a thesis may be waived, on the recommendation of the adviser (see page 17) and with the approval of the Dean of the Graduate College, provided application to waive the thesis is made at the time for announcing thesis subjects. A student excused from writing a thesis must replace it with courses of instruction.

REQUIREMENTS FOR THE SECOND MASTER'S DEGREE

A graduate student who holds a master's degree from the University of Illinois or from another accredited institution and who desires to become a candidate for a second master's degree from the University of Illinois in a different field, must meet the following requirements:

1. Two semesters or the equivalent in residence at the University of Illinois.

2. Satisfactory completion of at least six units of work beyond those submitted in partial fulfillment of the requirements for the first master's degree, of which four must be in the major field.

By petition, two units in the minor or major which were completed in partial fulfillment of the requirements for the first master's degree may be accepted as part of the six units mentioned in (2) above, but if the first degree was obtained at an institution other than the University of Illinois, credit for the two units must be established by direct examination.

REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN ENGINEERING

Residence. For the degree of Doctor of Philosophy the student must spend in resident study at an accredited educational institution all three of the "years" required to obtain the degree, such "years" being defined as follows:

1. First Year. The time required to complete eight units of graduate work with satisfactory grades in courses and to pass one foreign language examination.

2. Second Year. The time required to progress from the completion of the first year's work through the completion of the preliminary examination (see page 16). This involves obtaining satisfactory grades in eight units of graduate work beyond the first year's work, passing the second foreign language examination, and passing the preliminary examination. The satisfactory completion of these items permits the student to become a candidate for the doctorate.

3. Third Year. The time spent between successful completion of the preliminary examination and the completion of all requirements for the doctor's degree.

A student who spends the first two years in residence at the University of Illinois may, by petition, request permission to spend the last year *in absentia.* A student who has completed the first year of graduate work elsewhere must be in residence during the two remaining years. In exceptional cases a student with two years of graduate study elsewhere, who satisfies his major department by oral or written examination that he has completed work equivalent to the normal departmental requirements, will be permitted to take his preliminary examination after he has fulfilled the language requirements. If such a student passes the preliminary examination, he may complete the requirements for the doctorate by devoting the third year to research in residence.

A student may satisfy the residence requirement in part by attending summer sessions at the University of Illinois, attendance during four summer sessions being considered the equivalent of one year's residence. However, at some time during the second or third year of his doctoral program the student must be in residence at the University of Illinois through two successive semesters. A half-time assistant registered for three units a semester must spend three successive semesters in residence to satisfy this requirement.

Work Done Elsewhere. A graduate student who has taken graduate work in other approved institutions may, by petition to the Dean of the Graduate College, obtain credit for not more than four units toward the second year of graduate study. If the credit was earned at an institution other than the University of Illinois, proficiency in the subject matter needs to be demonstrated by examinations given by the respective departments teaching the subject matter for which credit is desired. (Also see the preceding section on Residence.)

Majors and Minors. A student who expects to become a candidate for the degree of Doctor of Philosophy is required to pursue a major group of subjects in the area of his research interest. He is also required

to choose one or two minor subjects. If only one minor is chosen, it is called a "sole minor," and must be taken in an area outside his major department. Credit for it must be earned by work representing not less than four units. If two minors are chosen, the minimum requirement for each is two units; the first minor may be in a subject closely related to that of the major or, with the approval of the adviser, it may be taken in a division of the major field of study. In the latter case the second minor must be taken in an area outside the major department.

Language Examinations. The student will be required to demonstrate, by examination at the University of Illinois, an adequate ability to read, with the help of a dictionary, two of the following languages: French, German, or Russian. No student will be considered as beginning his second year of graduate study until he has passed the examination in at least one of these languages. The second language examination must be passed at least two months before his preliminary examination, or during the semester (or Summer Session) preceding that in which he is admitted to the preliminary examination. The dates of the language examinations and the dates when application for admission to these examinations must be made are given in the Graduate College bulletin. Special non-credit courses designed to prepare graduate students for the language examinations are offered, and a student may register in one such miscellaneous course in addition to a normal graduate program.

Preliminary Examinations. A candidate for the doctor's degree must pass a preliminary examination intended to test his knowledge of his major and minor fields of study. He will not be admitted to this examination before he has passed the two required language examinations, he has satisfactorily completed at least sixteen units of graduate work, and his adviser and the head of the department of his minor field of study consider that he has adequate preparation in his major and minor fields. Upon the recommendation of the adviser, the Dean of the Graduate College will appoint the examining committee for the preliminary examination. This examination will be partly or entirely oral.

Thesis. The degree of Doctor of Philosophy is primarily a research degree; consequently the candidate is required to demonstrate his capacity for independent research by the production of an original thesis on some topic connected with his major field of study. The subject of the thesis should be chosen by the end of the second year and must be reported through his preliminary examination committee and his adviser to the Graduate College at the time of his preliminary examination. The student should be registered in his thesis course for the number of units corres-

ponding to the amount of time devoted to thesis research, four units being the equivalent of the normal full-time program and five units the maximum.

Final Examination. When the thesis has been completed and the major adviser so recommends, the candidate will be given his final examination by a committee appointed by the Dean of the Graduate College. A student who, in the third year of study, fails to meet the expectations of the professors in charge of his work, or in any way fails to maintain the standard of scholarship and power of research expected of him, may be refused admission to the final examination. The final examination is oral, is conducted entirely in the presence of the examining committee, and is concerned primarily with the research work of the student as embodied in his thesis although it may be much broader and extend over the whole field of study of the candidate. The intention of the final examination is to verify that the candidate has a satisfactory grasp of his major subject as a whole and a general acquaintance with the fields of knowledge represented by his course of study.

ADVISERS

Upon consultation with the Head of the Department of Theoretical and Applied Mechanics or a designated representative, each graduate student makes arrangements for the selection of an adviser, a staff member who is interested in or engaged in the field of mechanics in which the student is interested. The adviser will acquaint the student with the various course offerings and work out with him a selection of courses which will fit his needs and designs and at the same time satisfy departmental and Graduate College requirements for the desired degree. A student working toward his doctorate will, in general, have as his adviser the staff member under whom he will write his thesis.

GRADES

Grades are recorded by the following letters: A, B, C, D, and E. Any graduate student who receives grades below B in two units of work must complete two additional units of work of A or B grade to qualify for an advanced degree. Three units of work with grades below B automatically disqualify a student as a candidate for either the master's or doctor's degree. A grade of E in any course in the major field precludes the conferring of a degree in the academic year in which the failure was incurred.

PART-TIME WORK AND STUDY

The normal program for a full-time student is four units[1] in a regular semester or two units in a summer session. An exceptionally competent student may register for up to five units a semester and two and one-half units in a summer session. A student who is employed must carry a program of academic work reduced in proportion to the time spent on his employment. The normal or base amount of academic work an assistant or others on the University staff may carry is limited by statute and is given in column 2 of the following table. A full-time or part-time assistant may, however, register for more than the normal or base amount, as shown in columns 3 and 4 of the table, provided the excess work is in research and provided the Head of the Department so recommends and the Dean of the Graduate College approves. Registration for excess credit would be in Theoretical and Applied Mechanics 491 and 492, Thesis, or 493 and 494, Special Problems.

Proportion of Time Employed	Maximum Number of Units			
	Semester			Summer
	Base	Research Excess	Total	
Full	1	1	2	1
Three-fourths	2	1	3	1
Two-thirds	2¼	¾	3	1
Half	3	1	4	1½
One-third	3½	½	4	2

From this schedule it is apparent that a student employed as a half-time assistant could not fulfill the minimum requirements for a master's degree in less than three semesters.

The maximum time that may elapse between the entrance upon graduate work at the University of Illinois and the completion of the work for a master's degree is six calendar years. For a doctor's degree not more than seven calendar years may elapse.

FACILITIES OF THE DEPARTMENT OF THEORETICAL AND APPLIED MECHANICS

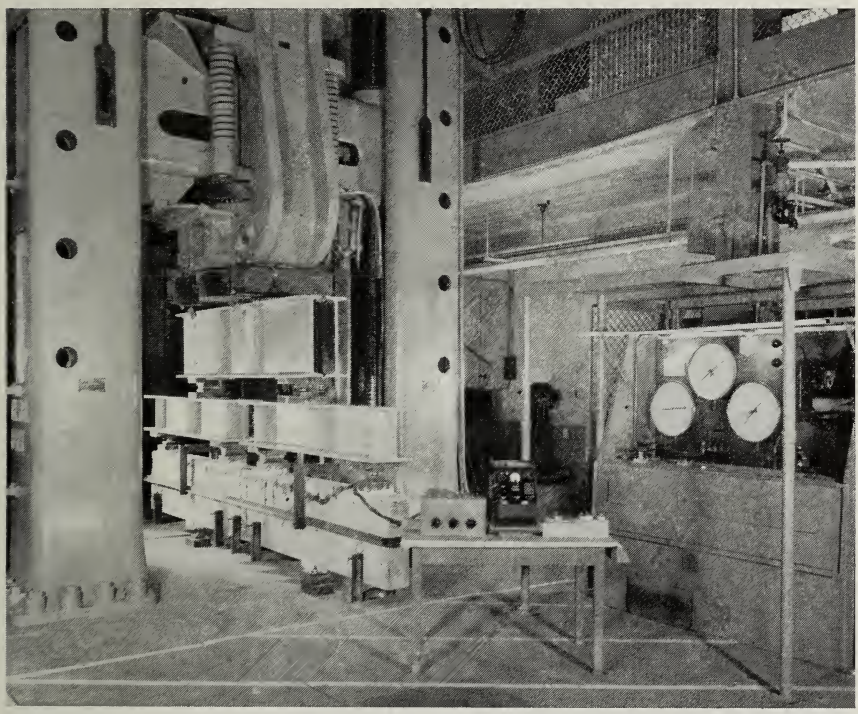
Most of the facilities of the Department are housed in Arthur Newell Talbot Laboratory, a large four-story brick building. About 50,000 sq. ft.

[1] One unit is considered the equivalent of four semester hours and requires about ten hours of time (class work, laboratory, field work, or private study) each week for one semester.

are occupied by the Department for teaching, research, and office space; the remainder of the building is occupied by the soil mechanics, concrete, bituminous, and structural research laboratories of the Department of Civil Engineering. The main feature of the building is the large crane bay, 40 ft. by 147 ft., with a clear height from basement level to roof.

The departmental facilities may be divided into the following specifically designated areas where the facilities are available for graduate study and research.

Large Crane Bay. This area contains the large capacity machines and is designed for the determination and the study of deformational behavior of large structures and machines, or members thereof, and the correlation of their behavior with other determinable mechanical properties of engineering materials. The main facilities are a 3,000,000-lb. capacity hydraulic testing machine (7.5 ft. between screws and accommodating tension or compression test pieces 38.5 ft. long), a 600,000-lb. testing machine, and a 300,000-lb.-in. torsion machine. Part of the floor



Deformations of steel and concrete of reinforced concrete beams are measured by means of electrical resistance strain gages in 3,000,000-lb. Emery-Tatnall machine. For view of entire machine see page 7.

is a heavily reinforced concrete slab 16 in. thick having eighty steel inserts capable of withstanding upward pulls of 50,000 lb. each. A ten-ton traveling crane 50 ft. above the floor is used to handle the large specimens and equipment. The area is shared with the Department of Civil Engineering.

Small Crane Bay. Adjacent to the large crane bay and connected to it is a two-story bay, 23 ft. by 112 ft. It is serviced by a six-ton traveling crane and has large doors opening on a drive so that large trucks can enter directly into the building. This bay is used primarily for research in plain and reinforced concrete. A portion of the reinforced concrete floor is 12 in. thick and has forty-two steel inserts capable of withstanding upward pulls of 10,000 lb. each. A 300,000-lb. universal testing machine having a 22-ft. table and a 300,000-lb. compression testing machine are located in this area, which is also shared with the Department of Civil Engineering.

Concrete Research. Half the basement of one wing is used for research in both plain and reinforced concrete. Space and equipment are available for storage of concrete materials and reinforcing steel and for the manufacture of test specimens. Two concrete mixers and moist room for storage and curing of specimens are some of the facilities. There also is specialized equipment for dynamic testing and for the study of behavior under repeated and long-time loading.

Hydraulics and Fluid Mechanics. The basement and first floor of one wing house the hydraulics and fluid mechanics laboratory. The basement contains concrete channels, one 5 ft. by 5 ft. and 175 ft. long, that are used to study the open-channel flow of water as well as for receiving the discharge from apparatus on the first floor. A standpipe 6 ft. in diameter and 65 ft. high provides a constant head for a flow of 6500 gallons per minute. The low-head pumping capacity is 13,500 gallons per minute at a head of 35 ft. Several types of viscosimeters, a two-dimensional water tunnel, two transparent-walled tilting flumes, various metering devices, pumps, and turbines are available for both teaching and research. Some facilities are available for the study of the flow of oil and air as well as of water.

Properties of Materials. On the second floor of one wing are located the facilities for instructional work in mechanical properties of engineering materials. Eleven universal testing machines of 50,000-lb. to 200,000-lb. capacities as well as hand operated torsion and beam-testing machines, impact machines, hardness testing machines, and various types

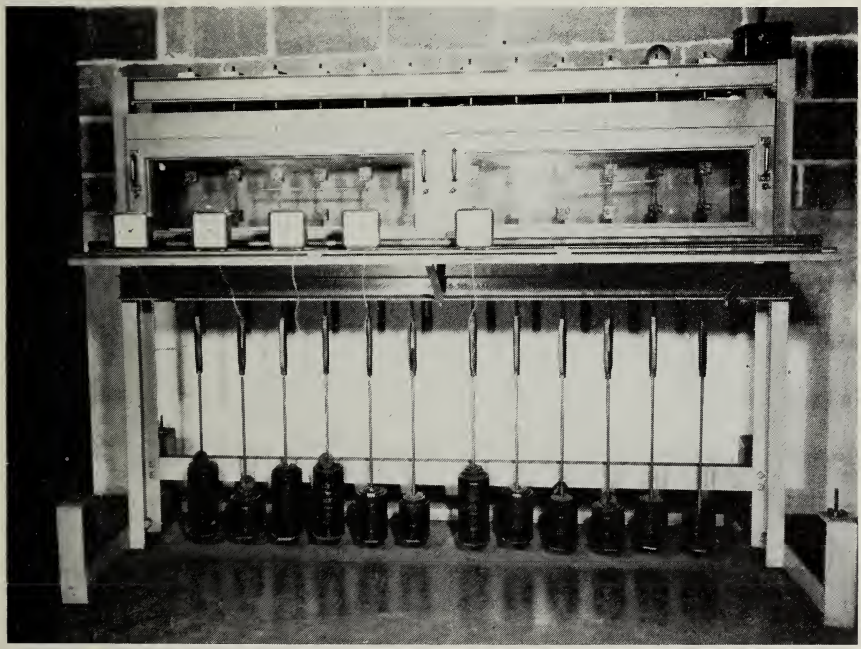
of strain measuring devices (including autographic recording mechanisms) are available for both instructional and research purposes.

Fatigue. Work in fatigue of metals has been in progress since 1919. This laboratory occupies half of one wing and is well equipped with various types of repeated load machines — bending, torsion, direct stress, and combined stress. Facilities for corrosion fatigue and fatigue at elevated temperatures are also available. Most of the electronic equipment, oscilloscopes, etc., for measuring strains are also housed in this laboratory, although they are available for use on all investigations.

Plastics. A constant temperature and constant humidity room in the basement is used for the study of fatigue, creep, impact, and other mechanical properties of plastics and laminated materials. Some of the equipment can also be used for similar studies of metals.

Vibration. In this laboratory are models illustrating various types of vibrations and frequency meters, harmonic analyzer, etc., required in the study of free, forced, damped, and self-induced vibrations.

Photoelasticity. Both two- and three-dimensional methods of photoelastic analysis are used. The equipment consists of two polariscopes,



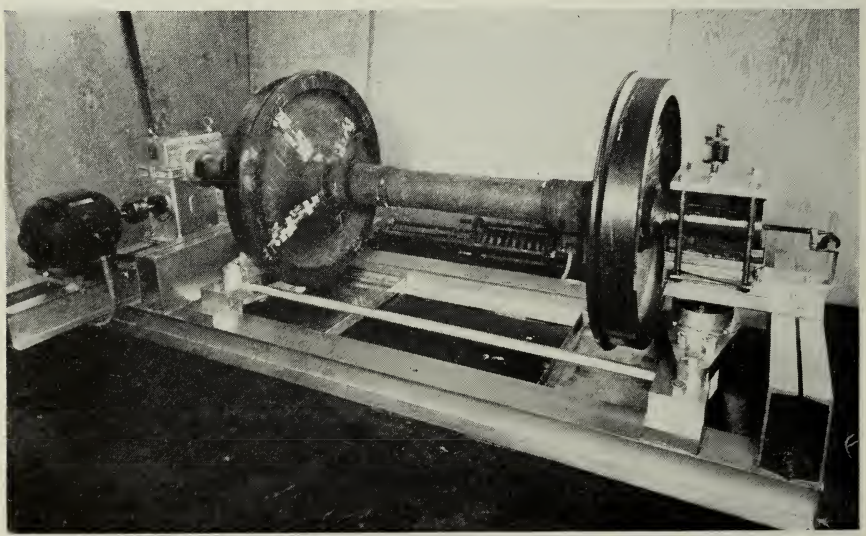
Experimental study of the effects of time and temperature on the behavior under load of lead alloys used for electric cable sheathing.

loading frames, camera, and other special apparatus needed for the three-dimensional studies.

Creep. The effect of the time and temperature on the behavior of metals, particularly alloys of lead, and plastics subjected to sustained loads are studied. In addition to creep and stress-rupture, both vibratory and slowly repeated loadings are used.

Railroad Rails. The principal features of this laboratory are the rolling load machines which are specially designed and built for determining the modes of failure of railroad rails and the behavior of bolted and welded rail connections under conditions simulating those in service. Metallographic polishing equipment, a metallographic microscope, and dark rooms for etching and photographic development and printing are available to all who need such equipment in their research or thesis investigations.

Railway Car Wheels. This is the one Department activity that is housed in a separate building. It contains special testing apparatus developed for the determination of the stresses, temperatures, and structural phenomena developed in the rotating wheel by brake applications and for the study of the performance of brake shoes. Work has gone on almost continuously since the first equipment was built in 1908-1909. Present equipment includes a 350-hp. steam engine capable of driving



The behavior of full-size railway car wheel and axle assemblies is studied under repeated loads simulating those applied in service.

wheels at a speed equivalent to 115 miles per hour and devices capable of exerting forces up to 20,000 lb. on each brake shoe.

Machine Shop. The Department has its own machinists and machine shop containing some thirty-five machines for the preparation of specimens and the building of special instruments and apparatus. In this shop and in the various laboratories a total of fifteen mechanics of various skills are employed. These men and equipment are available for the manufacture of specialized equipment designed by graduate students and staff members as well as for the controlled production of test specimens.

Collection of Photographs. In the hallways of Talbot Laboratory hangs an unusually large collection of photographs of men prominent in the fields of mechanics of solids and fluids, starting from the very earliest date, and below each photograph is a brief statement of the man's work. There is thus readily available for quick reference an enormous amount of background material regarding the men who have been active in the development of mechanics, who have enunciated the great ideas, and who have contributed to its history and philosophy.

Mechanics Club. In order to afford graduate students and young staff members an opportunity to discuss topics in the many areas covered by mechanics, a club having informal weekly meetings has been organized. Members of the staff present appropriate topics, and the meetings are then open for discussion.

Miscellaneous. In the Department are a number of electric computing machines and cameras, moving and still, and these are available to graduate students for use on their research projects. The University also operates a Photographic and Blueprint Department and a Statistical Service Bureau through which use may be made of IBM punched card tabulating and computing equipment. A high-speed electronic digital computer with a memory capacity of 1,024 numbers of 40 binary digits (13 decimal digits) and a multiplication speed of approximately 1,200 pairs of numbers per second has been built by the University and may be used, under supervision.

ENGINEERING LIBRARY

The Engineering Library, located on the first floor of Civil Engineering Hall, is one of the many college or departmental units into which the library of the University of Illinois is divided in order that it can most readily serve the needs of students and faculty. Most of the books pertaining directly to engineering are housed in the Engineering Library.

It contains 52,000 volumes, including books, bound volumes of magazines, and publications of engineering societies. More than 550 technical magazines and publications of engineering societies are currently received, there is a good collection of biographies of engineers, and the collection of early books on mechanics and strength of materials is considered among the best in the country. To aid in reference and research work there is a complete set of the Engineering Index and of about twelve other indexes. The Engineering Library also contains a large number of technical books from other countries and has an excellent collection of general technical dictionaries in several foreign languages with definitions in English, as well as similar dictionaries in special fields of engineering. Books on engineering that are infrequently used may be found in the Main Library, which, along with the college and departmental units, comprises the third largest library among all educational institutions in this country.

GRADUATE COURSES IN THE DEPARTMENT OF THEORETICAL AND APPLIED MECHANICS

The formal courses listed in this booklet cover the subject matter for which there is the greatest demand. Staff members and facilities are available to provide for individual study in areas not covered by these courses, and students may undertake such special studies by registering in Theoretical and Applied Mechanics 493, Special Problems. By making use of this provision and by selecting a suitable thesis subject, extensive graduate study and research can be carried on in almost any phase of mechanics, even if it is not treated in a formal course.

Those courses that have numbers between 300 and 400 are open to both graduate students and advanced undergraduates; those numbered 400 or more are for graduate students only. Where the credit for a course is listed as one-half to one unit and one unit of credit is desired, a term paper on a topic largely of the student's choice must be prepared; the topic may be theoretical, analytical, experimental, or based on library research, depending on the topic. The amount of thesis credit to be earned during any one semester depends upon the degree sought and whether or not a full graduate program is being carried.

Prerequisites are listed only when they constitute advanced courses or undergraduate courses other than the usual courses in statics, dynamics, strength of materials, and fluid mechanics or hydraulics, including laboratory work in strength of materials and fluids, offered in well-established colleges of engineering. If the preparation for a graduate course is con-

sidered inadequate the student may be required to take, without credit, certain undergraduate courses.

No standard program of study can be set up which will fit the needs of all graduate students. A standard program is actually undesirable because the varying maturity and purposefulness of graduate students requires individuality in programs. It is generally suggested, however, that a candidate for the doctor's degree take at least one course in several fields of mechanics, such as mechanics of materials, fluids, dynamics, and mathematics.

311. Mechanical Vibrations. Kinematics of vibratory motion; comprehensive study of vibrating systems having a single degree of freedom. Specific topics are natural frequencies in undamped vibration and the energy (Rayleigh) method; viscous, Coulomb, and solid (hysteresis) damping; forced vibration; work done by harmonic forces; method of complex algebra; critical speeds and balancing; balancing machines; vibration isolation; vibration instruments. For systems with several degrees of freedom, specific topics are modes; coupled vibrations; vibration absorbers and dampers; vehicle suspension; Holzer's analysis for torsional systems. First semester; one unit. P. G. Jones.

323. Advanced Laboratory in Materials Testing. A laboratory course stressing technique and the obtaining of reliable experimental data. Specific topics are study of various types of testing machines; calibration of testing machines; calibration and use of various types of extensometers and strain gages; determination and correlation of the mechanical properties of five different materials under various types of tests — tension, compression, torsion, flexure, impact, and hardness; testing of certain special materials such as wire, thin sheets, and rubber; the use of large machines, including the 3,000,000-lb. Southwark-Emery hydraulic testing machine. First and second semesters; one-half to one unit. W. L. Collins, W. J. Putnam.

326. Experimental Stress Analysis. Methods of extending and applying basic physical laws to the measurement of stresses or deformations that are of significance in the engineering design of load resisting members are studied. Optical, electrical, and physical properties of matter are systematically applied to the instrumentation and measurement of model or prototype stresses. Specific topics are photoelasticity; significant mechanical characteristics of materials; accuracy *vs.* sensitivity of measurement; dynamometers; strain measuring devices; measurement of vibration stresses; models and analogies; brittle coatings; electrical resistance gages. First and second semesters; one-half to one unit. Prerequisite: Theoretical and Applied Mechanics 421 is desirable. C. E. Bowman, T. J. Dolan.

334. Fluid Mechanics and Advanced Hydraulics. A study of the basic properties of fluids in general, particularly those that influence the flow of fluids in pipes and open channels; includes some laboratory work. Present-day use of

pipe lines to transport fluids other than water makes important the understanding of the effect of viscosity on flow and the transformation and use of the energy in fluids as used in pumps and turbines. Specific topics are viscosimetry; dimensional analysis; effect of boundary conditions; cavitation; water tunnel; hydraulic jump; water hammer; pumps; turbines. Second semester; one-half to one unit. W. M. Lansford.

412. Vibration Analysis. A continuation of Theoretical and Applied Mechanics 311. Specific topics are systems of several degrees of freedom; applications of generalized coordinates and Lagrange's equations; boundary value problems in vibration of elastic bodies, including strings, rods, and beams; Stodola's method; iteration process and matrix procedure; vibrations in reciprocating machines, airplane structures, and propellers; impact and transient vibrations; self-excited vibration; stability; non-linear systems. Second semester; one unit. Prerequisite: Theoretical and Applied Mechanics 311. P. G. Jones.

416. Energy Methods in Mechanics of Materials. The derivation, interpretation, and application of various principles of energy and of related potential functions for determining the relations between loads on members and the resulting deflections and internal forces. Specific topics are the principles of strain energy and so-called complementary energy; Castigliano's theorem; principles of least work, minimum potential energy, and virtual work; a comparison of the principles and methods with emphasis on advantages and limitations of the methods under various conditions, including linear elasticity and non-linear behavior; applications of the methods of engineering problems involving both statically determinate and statically indeterminate members. Second semester; one unit. H. L. Langhaar.

421. Mechanics of Materials. Methods of obtaining relations between loads and the significant stresses and strains for structural and machine members for which the equations developed in elementary mechanics of materials are inadequate. Analytical methods for solving engineering problems, rather than empirical rules, are emphasized. Specific topics are relations of stresses and strains at a point; Mohr's circle and the dyadic circle for stress and strain; theories of failure and their significance; properties of an area; stresses and deflections under static loads of beams with only one axis of symmetry; unsymmetrically loaded beams, curved beams, torsionally loaded members having non-circular cross sections, and thick-walled cylinders; stress concentration, including mathematical and mechanical methods used in determining the magnitudes of localized stresses and the theoretical and significant values of stress concentration factors. First semester; one-half to one unit. W. E. Black, J. O. Smith.

422. Mechanics of Materials. A continuation of Theoretical and Applied Mechanics 421. Specific topics are problems in stress and deflection of various members under static loads, comparison of analyses by theory of elasticity and procedures in mechanics of materials, beam on a continuous elastic support, contact stresses and flat plates; significant loads on members undergoing some

allowable plastic deformation, straight beams, curved beams and thick-walled cylinders; instability, elastic and inelastic buckling of straight members, collapsing of tubes and buckling of thin plates; elastic energy method applied to problems involving statically indeterminate members. Second semester; one unit. Prerequisite: Theoretical and Applied Mechanics 421. W. E. Black, J. O. Smith.

424. Properties of Engineering Materials. The significance of the mechanical properties of materials, particularly metals, with emphasis on the effects of time, temperature, and state of stress on the behavior of load-resisting members. Specific topics are significance and limitations of the commonly determined properties; specifications of the American Society for Testing Materials; atomic and crystalline structure; control of properties; a rational procedure of design; modes of failures, particularly general yielding, brittle fracture, progressive fracture (fatigue), and creep. Second semester; one-half to one unit. W. L. Collins.

427. Properties and Behavior of Plain Concrete. Theories used in the design of concrete and the factors affecting the strength of the material and of the test piece. Specific topics are behavior of plain concrete under different types of loading, such as long time and repeated; behavior of plain concrete subjected to uni-, bi-, and tri-axial states of stress. The studies involve critical reviews of experimental and analytical investigations. First semester; one-half to one unit. C. E. Kesler.

431. Theory of Flow of Incompressible Fluids. Theoretical fluid mechanics forming the basis of many modern developments. Specific topics are introduction to Gibbs' vector analysis; fundamentals of frictionless flow theory; Euler's differential equations of motion; velocity potentials; stream functions; sources and sinks; solutions of axially symmetrical flow problems; elements of complex variable theory with applications to plane flow. First semester; one unit. Prerequisite: One advanced mathematics course is desirable.

432. Theory of Flow of Incompressible Fluids. A continuation of Theoretical and Applied Mechanics 431. Specific topics are Blasius' theorems of lift and moments; introduction to conformal mapping and two-dimensional airfoil theory; vortex motion; Helmholtz's theory of line vortexes and vortex sheets; Biot-Savant theorem for determining the velocity field induced by line vortexes; stresses in viscous fluids; Navier-Stokes equations; elementary solutions of viscous flow problems; elements of lubrication theory; differential equations of the laminar boundary layer. Second semester; one unit. Prerequisite: Theoretical and Applied Mechanics 431.

436. Dimensional Analysis and Theory of Models. A course developing the basic methods of dimensional analysis, with applications to the theory of models and the planning of experiments. An integrated picture of important applications in various fields of engineering and a broad understanding of the uses and limitations of the subject are presented. Specific topics are selected

from the following: nature and use of dimensions; principles of dimensional analysis; systematic calculation of dimensionless products; algebraic theory of dimensional analysis; similarity and model laws; differential equations and similarity; dimensional analysis applied to problems of stress and strain, fluid mechanics, theory of heat, and electrical engineering. Second semester; one-half to one unit. H. L. Langhaar.

451. Theory of Elasticity with Applications to Engineering Problems. The mechanics of two-dimensional elastically deformable bodies, based on the fundamental concepts of equilibrium, geometry of strain and properties of materials. The relations between stresses, strains, and displacements are studied in detail. Specific topics are the derivation of equations of equilibrium and compatibility, in terms of both rectangular and polar coordinates, and their reduction to one equation by the introduction of a stress function; solution of problems by means of the stress function; strain energy methods; principles of virtual work, least work, and of Castigliano and their applications. First semester; one unit. H. L. Langhaar.

452. Theory of Elasticity with Applications to Engineering Problems. A continuation of Theoretical and Applied Mechanics 451 dealing primarily with three-dimensional problems. Specific topics are derivation of the equations of equilibrium and of compatibility in terms of stress and in terms of displacements; applications of equations of equilibrium and compatibility to problems in torsion, bending, and thermal stress; axially symmetrical stress distributions, with particular application to bending of circular plates and contact stresses between spherical bodies. Second semester; one unit. Prerequisite: Theoretical and Applied Mechanics 451. H. L. Langhaar.

461. Inelastic Behavior of Engineering Materials (Theory of Plasticity). An outline of a general theory of inelastic behavior involving the relations between loads and stresses and strains in various members that are stressed beyond the elastic range. The cases considered include those in which the inelastic actions involve bodies which are made of materials that behave ideally viscous, ideally plastic, and combinations of the two. Some specific topics are mechanisms of inelastic action of members in which the stresses and strains are essentially uni-axial, such as straight beams, curved beams, and members subjected to combined axial and bending loads; deflection of beams; statically indeterminate members loaded inelastically; inelastic buckling; "shake down" of simple statically indeterminate members; etc. First semester; one-half to one unit. J. O. Smith.

462. Inelastic Behavior of Engineering Materials (Theory of Plasticity). The physical and mathematical formulation of the mechanics of inelastically deformed bodies, plastic stress-strain laws, and their association with yield and loading functions. This course deals primarily with members subjected to bi-axial and tri-axial stress conditions. Specific topics include applications to flexure and torsion of prismatic members; expansion of thick-walled cylinders

and spherical shells; introduction to problems in plane plastic flow and variational plasticity. Second semester; one-half to one unit. Prerequisite: Theoretical and Applied Mechanics 451 or equivalent course. J. O. Smith, M. C. Steele.

464. Theory of Buckling. The pertinent information and theoretical background required for the prediction of failure by buckling of structures such as airplanes, ships, bridge trusses, fabricated towers and shells; practical illustrations. Specific topics are elastic columns with various end restraints; buckling of frameworks, arches, rings, and plates; inelastic buckling of columns and plates; lateral buckling of beams; energy theory; Ritz procedure; Euler's equation of the calculus of variations. Second semester; one-half to one unit. H. L. Langhaar.

491. Thesis (Master's). A thesis is designed for the individual development of research ability. It is preferred that a thesis be a combination of analytical and experimental work, but it might be of either type; extensive library work is usually required. The work may be under the direction of any staff member interested in the problem selected by the student and may be in any of the various fields of mechanics. It is advantageous that registration be extended over two semesters. First and second semesters; one-half to two and one-half units. Staff.

492. Thesis (Doctor's). Similar to Theoretical and Applied Mechanics 491, but must be independent research on an original topic. First and second semesters; one-half to four units. Staff.

493. Special Problems. An opportunity for the student to express his individual initiative in research on some problem that is of particular interest to him. This is particularly true for students not majoring in mechanics but who, in other courses, have found a problem in mechanics that they wish to explore. The work may be analytical or experimental and may be done under the direction of any staff member interested in the problem selected by the student. The work may be in any of the various fields of mechanics such as mechanics of materials, properties of materials, theory of elasticity, vibrations, reinforced concrete, hydraulics, fluid mechanics, creep, and fatigue. A written report describing the project and the results is required. First semester; one-half to two units. Staff.

494. Special Problems. Similar to Theoretical and Applied Mechanics 493. Second semester; one-half to two units. Staff.

SUGGESTED COURSES IN OTHER DEPARTMENTS

Graduate students in mechanics will find a wide variety of courses that they may take, generally as minors, in other departments of the University. A partial list of such courses is given below; for a complete listing of courses reference should be made to the Graduate College bulletin.

Aeronautical Engineering

Aerodynamics of Compressible Fluids
Theory of Continuous Media
Theory of Turbulence
Theory of Boundary Layer, Wakes, Jets

Civil Engineering

Hydrology and Flood Control
Water Power Engineering
Numerical and Approximate Methods of Structural Analysis
Investigations in Reinforced Concrete
Soil Mechanics
Structural Theory and Design
Analysis and Design of Plates and Slabs

Electrical Engineering

Engineering Analysis
Engineering Measurements
Electrical Network Theory
Servomechanisms and Automatic Control Devices
Boundary Value Problems

Mathematics

Differential Equations and Orthogonal Functions
Partial Differential Equations
Laplace Transformations
Introduction to Numerical Methods
Statistics
Linear Transformations and Matrices
Advanced Calculus
Real and Complex Variables
Vector and Tensor Analysis
High-Speed Computing
Mathematical Methods in Engineering and Science
Mathematical Methods in Physics

Mechanical Engineering

Thermodynamics
Dynamics of Machinery
Instrumentation and Measurements
Gas Dynamics
Machine Design
Metal Cutting

Metallurgical Engineering

Physical Metallurgy
Physics of Metals
Mechanical Behavior of Metals
Metallurgical Kinetics and Thermodynamics

Physics

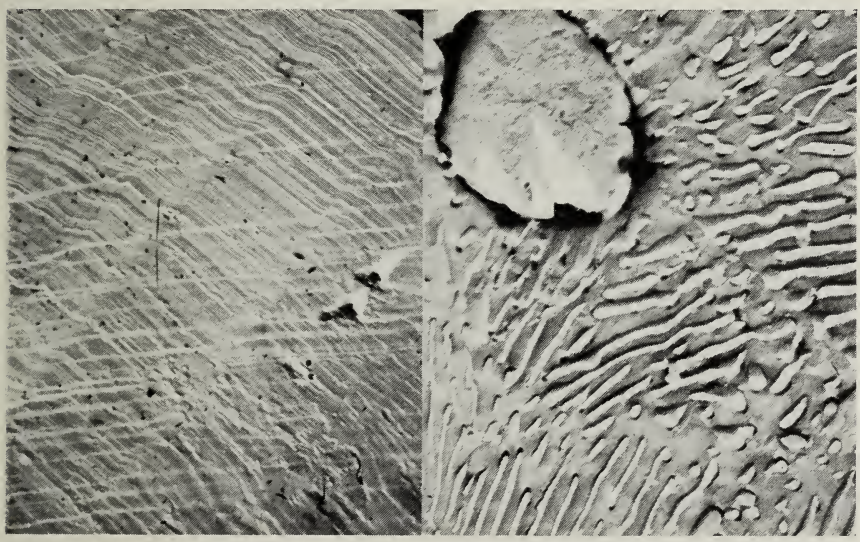
Dynamics
Theoretical Mechanics
Kinetic Theory and Statistics
Atomic Physics
Theory of Solids
Nuclear Physics

UNIVERSITY FELLOWSHIPS

A number of University Fellowships have been established by the Trustees of the University for students of outstanding scholastic ability and are available to those wishing to take graduate work in Theoretical and Applied Mechanics. For first-year graduate students of ability and

promise the fellowships carry a stipend of $900 and exemption from the payment of tuition and all fees of the regular academic year, except the hospital and medical service fee of $5 a semester. Fellowships open to second-year and third-year graduate students carry stipends of $1,000 and $1,100, respectively, and exemption from tuition and fees as noted above. Candidates for first-year fellowships must be graduates of the University of Illinois, or of colleges or universities having equivalent requirements for bachelor's degrees. To be eligible for a second-year fellowship the applicant must have completed his first year of graduate study (see page 14) by the beginning of the academic year in which the award is to be effective. To be eligible for a third-year fellowship an applicant must have passed the preliminary examination not later than about six weeks after the beginning of the semester during which the fellowship is effective.

Application for a fellowship must be made on forms obtainable from the Dean of the Graduate College and must be returned to the Dean of the Graduate College not later than February 15 of the academic year preceding that for which the fellowship is desired. Applications received later than February 15 will not be considered until after April 15, the date when appointees from the first list of applications must accept or refuse their appointments. Nominations to fellowships are made on the



The electron microscope is used for studies of structure and deformation of metals. Left — Three-directional slip in a crystal of 60-40 brass (original magnification 37,800). Right — Pearlite with small inclusion (original magnification 35,000).

grounds of worthiness of character, scholastic attainments, and promise of success in the principal line of study or research to which the candidate proposes to devote himself. The recipient of a fellowship agrees that he will undertake no employment during the tenure of the fellowship and that he will neither attempt to hold concurrently any other fellowship carrying a stipend, nor abandon the appointment during the year.

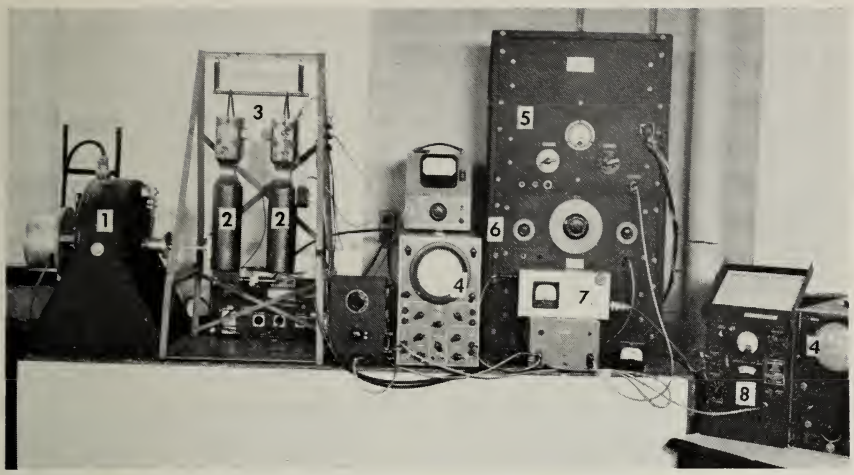
TEACHING ASSISTANTSHIPS

A number of teaching assistantships on one-half time or one-quarter time basis are available to graduate students in Theoretical and Applied Mechanics. The stipend for an academic year of two semesters is $1,350 for a half-time assistant and $675 for a quarter-time assistant, and exemption from tuition, laboratory, library, and supply fees. A half-time assistant may carry up to three units of graduate work each semester and must meet the residence requirements given on pages 12 and 14. The greater length of time required for an assistant to secure a degree is compensated by the gaining of teaching experience. The Department stresses high quality for this teaching and has a policy of providing considerable orientation and direction to its teaching assistants; teaching quality is not subordinated to graduate study. Inquiries concerning these positions should be directed to the Head of the Department of Theoretical and Applied Mechanics.

RESEARCH ASSISTANTSHIPS IN THE ENGINEERING EXPERIMENT STATION

The Engineering Experiment Station was established in 1903 to conduct research and make studies of problems of special importance to engineering, and to stimulate and enrich engineering education. Its research projects are carried on within the various departments in the College and are integrated closely with the teaching program. By undertaking a graduate study program or a thesis in close association with some one of the projects carried on in the Experiment Station, the graduate student may come into contact with aspects of his specialty which he would rarely touch in a purely academic study. The Experiment Station makes available apparatus, equipment, and the services of mechanicians, all of which may materially facilitate the progress of research investigations carried on by graduate students.

Half-time research assistantships with an initial stipend of $1,350 for an academic year of two semesters, and exemption from the payment of



Development of electronically excited resonance type fatigue testing equipment

1. Electrodynamic exciter
2. Vibrating arms
3. Specimen
4. Oscilloscope
5. Power amplifier
6. Audiofrequency oscillator
7. Control circuit
8. S-R4 strain indicator

the usual tuition fee, etc., are open to graduates of approved technical colleges and universities intending to become graduate students in the Department of Theoretical and Applied Mechanics. Applicants to whom research assistantships are awarded must have outstanding scholastic records and other excellent qualifications such as integrity, attitude, initiative, ability to work with others, and willingness to accept responsibility. The applicant agrees to hold the appointment for one academic year, devoting one-half of his time to the work of the Engineering Experiment Station. Usually the appointment is then extended for another year. A half-time research assistant may carry up to three units of graduate work each semester. At the end of two academic years, if all requirements of the Graduate College have been met, the degree of Master of Science will be conferred, or, at least one year of residence toward the degree of Doctor of Philosophy in Engineering will have been earned.

A number of half-time research assistantships in Theoretical and Applied Mechanics are available. They include assistantships established by the University as well as others provided by cooperative research agreements with state and federal agencies, technical societies, engineering associations, and industries. Some of the general fields of research which are now active have been given on page 6. It is usually possible to assign a half-time research assistant to a project in the field of his special

interest. Often the research in which he is engaged will form the basis of his thesis, but his thesis is not restricted to this field.

Applications for research assistantships should be made to the Director of the Engineering Experiment Station or to the Head of the Department of Theoretical and Applied Mechanics not later than March 15. Application for admission to the Graduate College should be made after favorable action has been taken on the assistantship application.

FEES AND EXPENSES

Tuition

Residents of Illinois, except those holding scholarships, fellowships, and teaching and research assistantships, pay each semester a tuition fee of ..... $ 50.00

Residents of Illinois registered for two units or less pay for each unit or fraction thereof 16.00

Nonresidents of Illinois, except those holding scholarships, fellowships, and teaching and research assistantships, pay each semester a tuition fee of 160.00

Nonresidents of Illinois registered for two units or less pay for each unit or fraction thereof 40.00

Hospital and Medical Service Fee

All students registering for resident work, except those who are on University appointment other than fellows and scholars or on appointment in allied surveys and laboratories on the Urbana campus, and those who are registered for not more than one unit of graduate work, pay each semester a hospital and medical service fee of 5.00

Laboratory, Library and Supply Fee

Students taking more than two units of graduate work pay each semester a laboratory, library, and supply fee of 11.00

Students taking two units or less pay for each unit or fraction thereof 5.50

Illini Union Service Charge

All students registering for resident work, except those who are members of the University staff and others who are registered for not more than one unit of graduate work, are assessed each semester an Illini Union service charge of 7.00

Expenses

Although personal expenses may vary a great deal, the following estimates indicate the average cost for students: board, $12 to $15 a week; room rent, single rooms from $18 to $30 a month; double rooms from $15 to $20 a month for each person. A total budget of about $475 a semester, including fees but not major items of clothing and recreation, would be considered moderate.

HOUSING

The University is currently operating a temporary housing program for unmarried undergraduate and graduate students. These temporary accommodations are located in one-story frame buildings each accommodating sixteen men. Each building is divided into eight two-man sleeping rooms and four four-man study rooms, arranged as suites. Bathroom facilities are provided in each building. The rental rate per individual is $100.00 for one semester. The rate for room and board is $315.00 a semester when meals are taken in the near-by dining room of the Men's Residence Halls.

Graduate students are also eligible to apply for the following two types of University-owned family housing:

1. *Temporary Family Housing* units consisting of zero and one-bedroom furnished efficiency apartments, one- and two-bedroom furnished sectional houses, and two-bedroom unfurnished and furnished apartments. Monthly rental rates range from $36.00 to $50.00 and include the cost of utilities.

2. *The Student-Staff Apartment Buildings* at present consisting of 201 units of the following types: sleeping rooms for single individuals, zero bedroom, zero bedroom with dressing room, one bedroom, one bedroom with dining alcove, one bedroom with dinette, and two bedroom. These units vary in the degree of furnishings and a mimeographed brochure describing the furnishings provided is included with application forms. The rentals range from $55.00 to $110.00 a month and include the cost of steam heat and water; most of the zero bedroom units for graduate students rent for $65.00 a month.

Any student who is on the staff one-half time or less may apply for Temporary Family Housing on a student basis. A graduate student on more than a one-half time appointment must apply for family housing on a staff basis through the Head of the Department and the Dean of the College. Preference for assignment on a student basis to the Tem-

porary Family Housing units is given to married veteran students, not on active duty, who are residents of Illinois, or who were attending the University of Illinois at the time of their entry into military services of the United States. Applications are accepted during the months of July, December, and April, *only,* for housing beginning with the fall semester, spring semester, and summer session, respectively.

Units in the Student-Staff Apartment Buildings are made available to either veteran or non-veteran students. Any person maintaining a student or a combination of student and staff status is eligible to apply. The completed application form should be submitted to the Head of the Department of Theoretical and Applied Mechanics who will then transmit it to the Dean of the College of Engineering.

In addition to University-owned units, listings from private owners in the community are maintained at the Main Desk in Illini Hall. These listings generally include furnished and unfurnished apartment units, sleeping rooms with and without housekeeping accommodations, trailers and trailer spaces, etc. These accommodations should not be rented without inspection by the prospective tenant.

Complete information on University housing and on privately-owned housing as well as application forms for the various types of University housing may be obtained from University of Illinois Housing Division, Illini Hall, Urbana, Illinois.